T r a n s l a t i o n

of German Utility Model G 85 34 594.6

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A SPRAY HEAD FOR SPRAYING THERMOPLASTIC RESIN IN PARTICULAR HOT-MELT ADHESIVE

Description

The invention concerns a spray head for spraying a liquid thermoplastic resin of the type specified in the preamble of claim 1.

From DE-OS 2,836,545 or DE-OS 3,416,105 devices for spraying coating materials, in particular hot-melt adhesives, but also resins, are already known, in which the liquid coating material is fed from a source to a spray head which receives a gas via a second pipe. The spray head ejects the heated, liquefied coating material and the gas, generally air, simultaneously, so that the emerging coating material is atomized by the pressurised gas and deposited in the form of a spray curtain or spray on to the base to be coated.

In DE-PS 2,924,174 a spray head is shown for spraying a liquefied hot-melt adhesive, in which the heated adhesive emerges from a central feed channel. The gas outlet orifices are directed towards the axis of the outlet orifice of the adhesive channel and form a concentric slit aperture directly surrounding the outlet orifice for the adhesive, the stream

direction from the said slit aperture enclosing a sharp angle with the axis of the outlet orifice. A disadvantage of this arrangement is the unsatisfactory mixing of heated adhesive and gas, generally compressed air, so that an optimum spray pattern cannot be obtained. In particular a spray pattern once selected can no longer be varied.

A similar spray head is defined in DE-PS 405,450, where the gas outlet device is provided with an annular, conical channel surrounding the outlet orifice for the heated adhesive, inclining towards the filaments to be extruded from the outlet orifice for the adhesive. As the inlet orifices for the annular, conical gas channel are arranged displaced from one another on opposite sides of the outlet orifice for the adhesive a vortex effect on the gas in the feed channel is produced, this means that the emerging gas stream imparts a rotary movement component to the adhesive filaments leaving the outlet orifice. Hence, in a simple manner uniform dimensioning of the adhesive layer can thus be obtained, whereby these dimensions can, if required, be varied, namely by corresponding adjustment of the velocity of the emerging gas stream.

However, even this known spray head does not work in an optimal manner, as the mixing of the heated adhesive and the compressed gas leaves something to be desired. Also the form of the emerging, atomized adhesive filaments cannot be influenced any more.

The invention is thus based on the object of producing a spray head for spraying liquid thermoplastic resins of the type specified in which the above-mentioned disadvantages do not arise.

In particular a spray head is proposed which ensures good mixing of resin and compressed gas, generally compressed air.

This is attained, in accordance with the invention, by the features specified in the characterizing part of claim 1.

Preferred embodiments are defined in the features of the subclaims.

The advantages obtained by the invention depend in particular on the fact that in the mixing chamber, which is provided in the outlet area of spray head, the heated adhesive on the one hand, and the compressed gas on the other hand are thoroughly and completely mixed, thus a fine atomized resin curtain or spray can emerge from the narrow orifice or the narrow orifices of this mixing chamber; in this manner the resin can be applied to the surface to be coated as a thin, finely distributed film. The application area for the resin can be easily varied by alteration of the nozzle shape, the flow angle of the resin, the distance between the spray head and the surface to be coated, the velocity of the air and resin streams and finally by the corresponding constructive arrangement of the inlet orifices for the resin or the compressed air in the mixing chamber, as well as the outlet orifice(s) of the mixing chamber.

It is important here, that the resin is not deposited in the form of a continuous filament, but as a uniform, thin film onto the surface to be coated and there displays optimal adhesion.

It has proved advantageous if the gas is fed into the mixing chamber through a flow channel provided with flow guide elements, so that an optimum eddying together of the resin with the compressed gas in the mixing chamber is achieved.

The outlet orifice of the mixing chamber can be a thin outlet slit with a width of 0,3 mm or a circular outlet aperture with a corresponding diameter. Finally it is also possible to provide a number of outlet apertures of circular diameters arranged, for example, on a straight line.

In order to be able to influence the atomized resin emerging from the mixing chamber, additional gas outlet apertures are provided on the outside of the spray head in accordance with a preferred embodiment, the said outlet apertures are off-set from one another and each directs a stream of gas onto the atomized resin. Thus the atomized resin can be given a specific form as well as directional components.

These additional gas outlet apertures are either located in two diametrically opposed knobs with gas outlet apertures directed towards one another, or in a torus ring on the outside of the spray head with corresponding gas outlet apertures.

In accordance with a preferred embodiment the gas streams which are fed to the mixing chamber, on the one hand, and the gas streams on the outside of the nozzle on the other hand, can be adjusted independently of one another to predetermined flow values of pressure and/or volume, so that the corresponding parameters can be adjusted independently of one another.

The invention is explained more closely by means of examples respecting the appended, schematic diagrams, in the following. The diagrams show

Fig. 1 a schematic illustration of an apparatus for spraying a liquid thermoplastic resin by a stationary spray head,

Fig. 2 a vertical section through the lower part of the spray head with the nozzle,

Fig. 2a an enlarged view of a vertical section through the lower end of the spray head,

Fig. 3 a view on the nozzle from below,

Fig. 4 a vertical section through a further embodiment of the lower part of the spray head,

Fig. 5 a view from below on this spray head,

Fig. 6 a vertical section through a third embodiment of the lower part of a spray head,

Fig. 7 a view on this nozzle from below,

Fig. 8 a schematic view of a hot-melt-adhesive pattern, as produced by several embodiments to Figs. 6, 7 arranged alongside one another, and

Fig. 9 a schematic view of a hot-melt-adhesive pattern, as produced by several spray heads to Figs. 6 and 7

arranged in a row, when the axis of the gas outlet apertures is arranged obliquely to the direction of the relative movement between the base to be coated and the spray heads.

In Fig. 1 a general device is shown indicated by the reference No. 10 for spraying thermoplastic resins, in particular hot-melt adhesives, having a liquefier 12, which can be, for example, of the type known from DE-OS 2,836,545. The liquefier 12 is provided on its upper side with a filler cap 14 for replenishing the resin.

In the following further details respecting "hot glue" or "hot-melt adhesive" are given.

The apparatus contains in addition a hot-glue hose 16, which in the left-hand part of Fig. 1 is shown larger than in the right-hand part. This hot-glue hose 16 ends in a spray head 18, on the underside of which a nozzle 19 is provided for spraying the hot glue onto a band 20 to be coated with the glue moving in the direction of the arrow; the emerging sprayed hot glue is indicated in Fig. 1 by dotted lines.

The hot-glue hose 16 is provided at its inlet end with a pipe connection 22 and at its outlet end with a pipe connection 24, which are connected to corresponding mating parts on the liquefier 12 and the spray head 18 respectively.

At the inlet end of the hot-glue hose 16 three lines are led outwards through its outer wall, namely a compressed-air inlet hose 28, which runs to a shut-off element in the form of a solenoid valve 30, to which compressed air flowing in the

arrow direction is applied, as well as two lines connected by plugs to the liquefier 12, namely a feed line 32 connected to the heating strip in the interior of the hot-glue hose and a control line 34.

At the outlet end an outlet hose 36 for hot air penetrates the outer wall of the hot-glue hose 16 and runs to the lower side of the spray head 18.

The hot-glue hose 16 is, for example, of the type known from DE-OS 3,416,105, that is, the air pipe is integrated in the hot-glue hose 16, so that the compressed air and the heated glue in the hot-glue hose are maintained at the prescribed temperature.

As an alternative to this the hot-glue hose 16 and the compressed-air pipe can be separate.

In the outlet hose 36 an adjustable valve 40 is provided for regulation of the compressed air fed to the spray head 18.

The compressed-air pipe branches off upstream of the solenoid valve 30, that is, one branch leads to the solenoid valve 30, while a bypass 38, bypassing the solenoid valve 30, is connected to the compressed-air pipe 28 downstream of the solenoid valve 10.

Through this bypass 38 a small quantity of air flows compared with the operating compressed-air flow and moreover, not only during spraying operation but also during operating pauses.

The spray apparatus 10 shown in Fig. 1 operates as follows: In

the liquefier 12 the hot-melt glue is inserted through the cap 14, heated and thereby liquefied; as the shut-off element for the feed of the liquefied glue is still closed (this shut-off element is located generally in the liquefier 12 and is not illustrated in Fig. 1), no hot glue can emerge from spray head 18.

However, a relatively small quantity of compressed air flows continuously through the bypass 38, which compared with the quantity of compressed air required for operation can be ignored; this compressed air flows through the hot-glue hose 16, part 36 with the valve 40, and emerges continuously from the nozzle 19 of the spray head 18.

At the beginning of a spraying operation a corresponding signal is given whereupon valve 30 in the compressed-air pipe 28 and the shut-off element of the liquefier 12 are simultaneously opened. The heated and thereby liquefied glue is pumped by a high-pressure displacement pump (not shown) in the liquefier 12 into the hot-glue hose 16 via pipe connection 22. Simultaneously solenoid valve 30 is opened, so that the total available compressed air flows into the spray head 18, via the solenoid valve 30, and the air hose 28 through hot-glue hose 16, and the air hose 36.

The hot glue leaves the end of the hot-glue hose 16 via the pipe connection 24 with about the same temperature as it had on entering the hot-glue adhesive hose 16; the compressed air also leaves the hot-glue hose 16 via the gas pipe part 36 with about the same temperature as the hot glue.

The compressed air heated thus is fed into the hot-glue stream

in the spray head 18 in such a manner that the hot glue is atomized, whereby the airstream has such a temperature that it does not lead, on the one hand, to premature hardening of the applied hot glue and, on the other hand, does not result in overheating the hot glue and thus harming its characteristics when leaving the spray head 18.

As a relatively small quantity of air flows continuously from the bypass 38 through the hot-glue hose 16 to the spray head 18, opening the solenoid vale 30 and the shut-off element for the hot glue can take place simultaneously.

Fig. 2 shows a vertical section through the lower part of the spray head 18 with the screwed-on, rather bowl-shaped nozzle 19. The pipe connection 24 for the feed of the heated adhesive can be seen, which then flows downwards through a central feed channel 40 in a holder 42 for the nozzle 19. This nozzle holder 42 is approximately cylindrical in shape and contains within its central feed channel 40 for the heated glue a pointed spike 44, which extends to the lower end of the feed channel 40 and thus also of the nozzle holder 42. At this lower end the central feed channel 40 for the heated glue closes in conically.

In Fig. 2 a passage 44 is indicated which is connected to the pipe 36 for the compressed air. From this passage 44 a flow channel 46 in the nozzle holder 42 runs down into an annular channel 48 which is formed between a reduced-diameter projection 50 on the nozzle holder 42 on the inside, and the inner wall of the nozzle 19 on the outside. From this annular channel 48 the compressed air flows through a channel 52 running inwards and downwards into a mixing chamber 54,

bounded at the lower end by the inner wall of the nozzle 19 on the one hand, and the lower, conical end of the nozzle holder 42 on the other hand, and again closes in conically (see also Fig. 2a).

The flow channel 52 is provided with flow guide elements 52a (see Fig. 2a), in the illustrated example namely, grooves or ribs on the outer wall of the lower, conical, reduced-diameter part 50 of the nozzle holder 52, whereby the angle at which the compressed air in the mixing chamber impinges on the hot glue emerging from the orifice can be influenced. As an alternative to the illustrated example knurling can, for example, be provided, and not only on the portion 50 of the nozzle holder, but also on the inner surface of the nozzle 19, so that the compressed-air flow entering into the mixing chamber can be made laminar or turbulent, as required.

The compressed air will then be fed to the mixing chamber 54 in such a manner that optimal mixing between the heated glue from the central channel 40 and the swirling compressed air takes place in the mixing chamber 54.

At its lower end the nozzle 19 is provided in the end view (see Fig. 3) with a round projection 56 having a central, slot-shaped outlet orifice 58 from the mixing chamber 54, from which the heated glue emerges downwards. This outlet orifice has a width of about 0,3 mm.

As an alternative to the embodiment to Figs. 2 and 3 the outlet orifice can be formed as a single, central bore of circular section in the projection 56 or, however, by several bores located on a straight line alongside one another having

a circular cross section. Such bores should have a diameter of about 0,3 mm.

The compressed air on the one hand and the heated glue on the other hand, are well mixed in the mixing chamber 54, so that the atomized hot glue leaves the outlet orifice 58 as a "hot-glue curtain" and can be deposited as a uniform, thin layer on the base 20.

Figs. 4 and 5 show an embodiment in which an adjustable valve 60 for the compressed air is provided in the passage 44, so that the quantity and/or the pressure of the compressed air fed to the nozzle 19 can be adjusted.

From the passage 44 the compressed air arrives in a similar manner as in the embodiment to Figs. 2 and 3, to a mixing chamber, in which the heated glue is atomized.

The nozzle holder 42 contains a second compressed-air connection 62 with a second adjustable valve 64. This connection 62 is connected to a flow channel 68 in the nozzle 19 via a flow channel 66 in the nozzle holder 42. A torus passage (not illustrated) in the interface between nozzle holder 42 and nozzle 19 connects both channels 66, 68 to a further flow channel 70 on the opposite side of the nozzle 19, that is, both flow channels 68, 70 are symmetrical to the centre of the nozzle 19.

Both flow channels 68, 70 in the nozzle 19 end in semi-spherical knobs 72, 74, located on the bottom outside of the nozzle 19, which are provided with outlet orifices 76, 78. In the vertical section in Fig. 4, it can be seen that these

outlet orifices 76, 78 are directed obliquely downwards onto the atomized hot glue emerging from the outlet orifice in the nozzle 19.

On the end view from below on the nozzle 19 to Fig. 5 it can be seen that both knobs 72, 74 and the outlet orifice 80 lie on a straight line. The outlet orifices 76, 78 of the knobs 72, 74 are however, so arranged parallel to one another that the emerging air streams flow past the outlet orifice 80 (see Fig. 5), that is, the "hot-glue curtain" emerging from the outlet orifice 80 is acted upon from both sides by the air streams from the knobs 72, 74 and thus receives a specific shape.

The shape of this hot-glue curtain can be influenced by the corresponding positional arrangement of the knobs 72, 74 and the air streams thus produced by them.

Figs. 6 and 7 show an embodiment differing from the embodiment to Figs. 4 and 5 in that a torus ring 82 is provided on the lower outside of the nozzle 19, connected to both the flow channels 68 and 70. The torus ring 82 contains an annular ring channel 84, provided with outlet orifices on the inside of the torus ring 82.

In the embodiment to Figs. 6 and 7 a total of four outlet orifices 86, 88, 90 and 92 are employed, arranged symmetrically around the outlet orifice 80 of the nozzle 19, that is, at 90° intervals.

These outlet orifices 86, 88, 90, 92 direct fine air streams onto the hot-glue curtain emerging from the outlet orifice 80.

whereby a specific spray pattern can be obtained. By corresponding changes in the position of the outlet orifices this spray pattern can be varied as required.

The external air streams can also be used in an embodiment of a spray head without a mixing chamber 54 in the nozzle 19, when the heated glue has been atomized in the usual manner by the compressed air.

Good results are achieved when the thermoplastic resins and, in particular, hot-melt adhesives have a viscosity in the range between 0 and 1 000 000 and, in particular between 0 and 750 000 cp.

The compressed air, or more generally the atomizing gas, should be heated, whereby temperatures in the range between 50° C and 200° C have proved suitable.

Fig. 8 shows a spray pattern such as can be obtained with several spray heads according to the embodiments to Figs. 4 and 5. Here the axes joining the outlet orifices 76, 78 of the nozzle heads 18 with one another, run at right-angles to the direction of the relative movement between the base 20 and the spray heads, whereby patterns 100 result, running at right-angles to this direction. In Fig. 8 the direction is indicated by the arrow.

This alignment utilizes the maximum width of the individual oval patterns in a particularly favourable manner.

A further, particularly favourable spray pattern is illustrated in Fig. 9; here the axes connecting the orifices

76, 78 together are oblique in relation to the direction of the relative movement between the base 20 and the spray head 18, as can be seen from Fig. 9. The optimal angle can be adjusted as required.

The spray pattern with this example is denser than with the spray pattern to Fig. 8, if all the other influencing parameters are unchanged. In some cases the overlapping between the individual spray patterns 100 can be reduced.

Claims

1. A spray head for spraying thermoplastic resin, in particular hot-melt adhesive comprising
a) at least one feed channel for said pre-heated resin,
b) an outlet orifice at the lower end of said feed channel,
c) a conically running feed channel for a gas stream, and
d) an outlet orifice for said gas channel aligning a gas stream to said emerging resin,

characterized in the following features:
e) said feed channel (40) for said pre-heated resin as well as said gas channel (52) discharging into a mixing chamber (54) from which sprayed resin emerges through a small opening (58).

2. A spray head according to claim 1, characterized in that a flow channel (52) for said gas is running from an annular channel (48) to said mixing chamber (54).

3. A spray head according to claim 1 or 2, characterized in that a cup like nozzle (19) is threaded on a cylindrical nozzle carrier (42), and that said flow channels (48, 52) for said gas are provided between said nozzle carrier (42) and the inner surface of said nozzle (19).

4. A spray head according to claim 2 or 3, characterized in that said flow channel (52) for said gas is provided with flow conducting elements between said annular

channel (48) and said mixing chamber (54), said flow conducting elements being in particular ribs and/or grooves.

5. A spray head according to any of the preceding claims 1 to 4,
characterized in that said outlet orifice (58, 86, 88, 90, 92) of said spray head (19) has a width of approximately 0,3 mm.

6. A spray head according to any of the preceding claims 1 to 5,
characterized in that said outlet orifice (58) is formed as a small gap.

7. A spray head according to any of the preceding claims 1 to 5,
characterized in that said outlet orifice is made of at least one circular bore.

8. A spray head according to any of the preceding claims 1 to 7,
characterized in that said mixing chamber (54) being cylindrical.

9. A spray head according to any of the preceding claims 1 to 8,
characterized in that said cylindrical mixing chamber (54) has a diameter of approximately 1,5 mm.

Summary

A spray head for spraying a liquid hot glue is provided with a feed channel for the heated glue as well as a channel for a gas stream ending in a small mixing chamber. From this mixing chamber the atomized hot glue emerges via a small outlet orifice. In order to be able to influence the atomized hot glue after leaving the spray head, further outlet orifices for gas streams are provided on the outside of the spray head. These outlet orifices can be located either in semi-spherical knobs or in a torus ring.

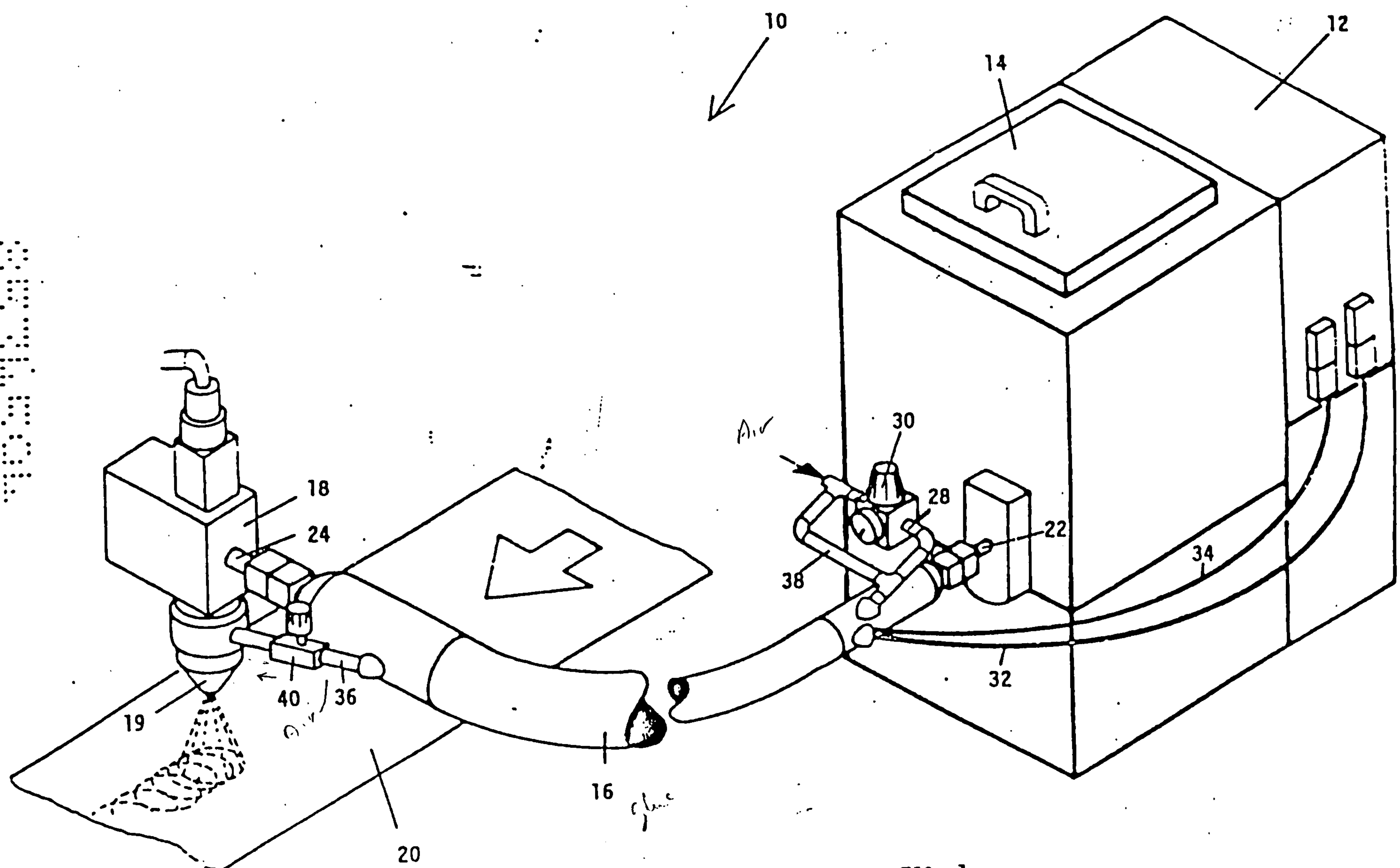

FIG. 1

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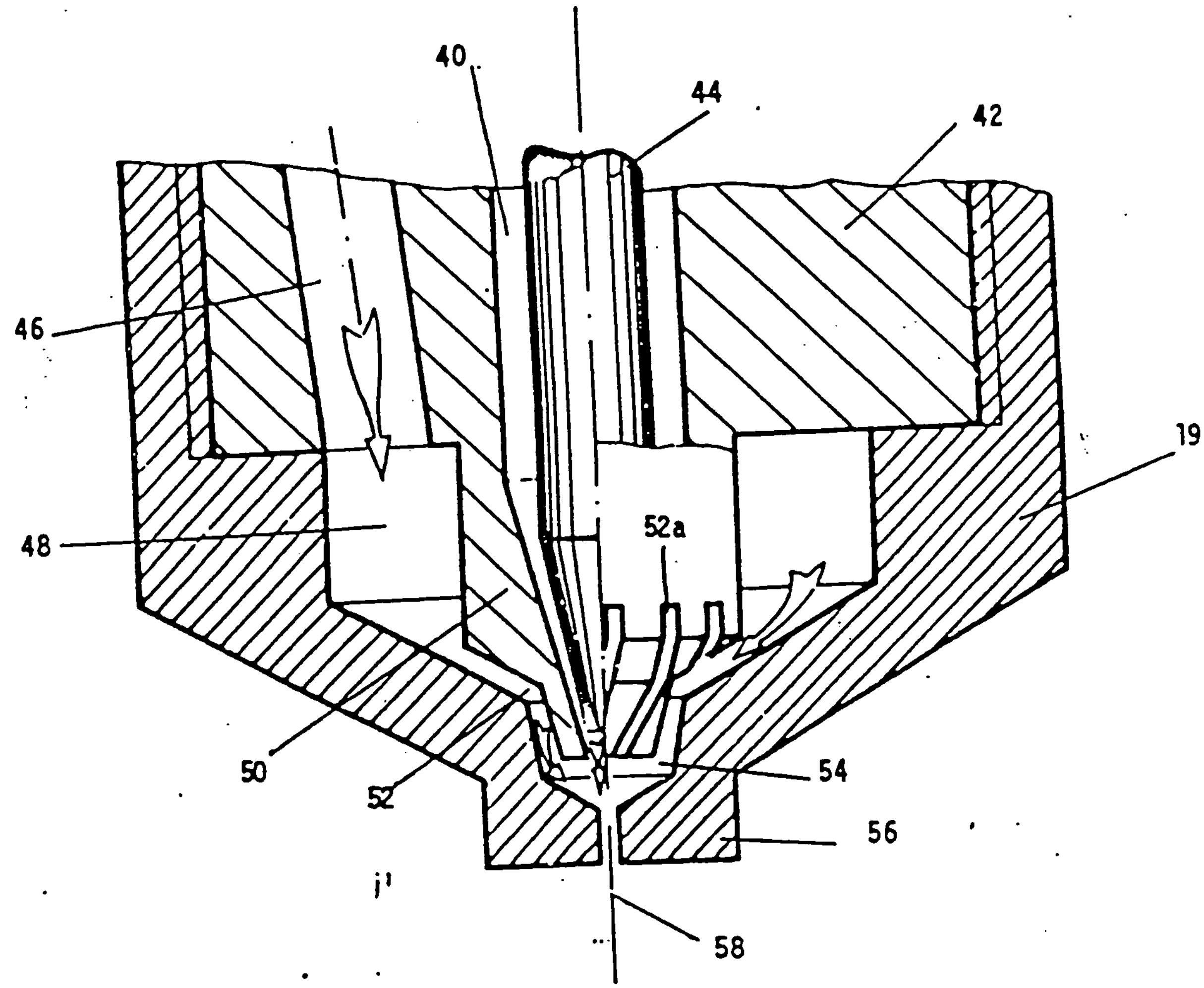

FIG. 2 a

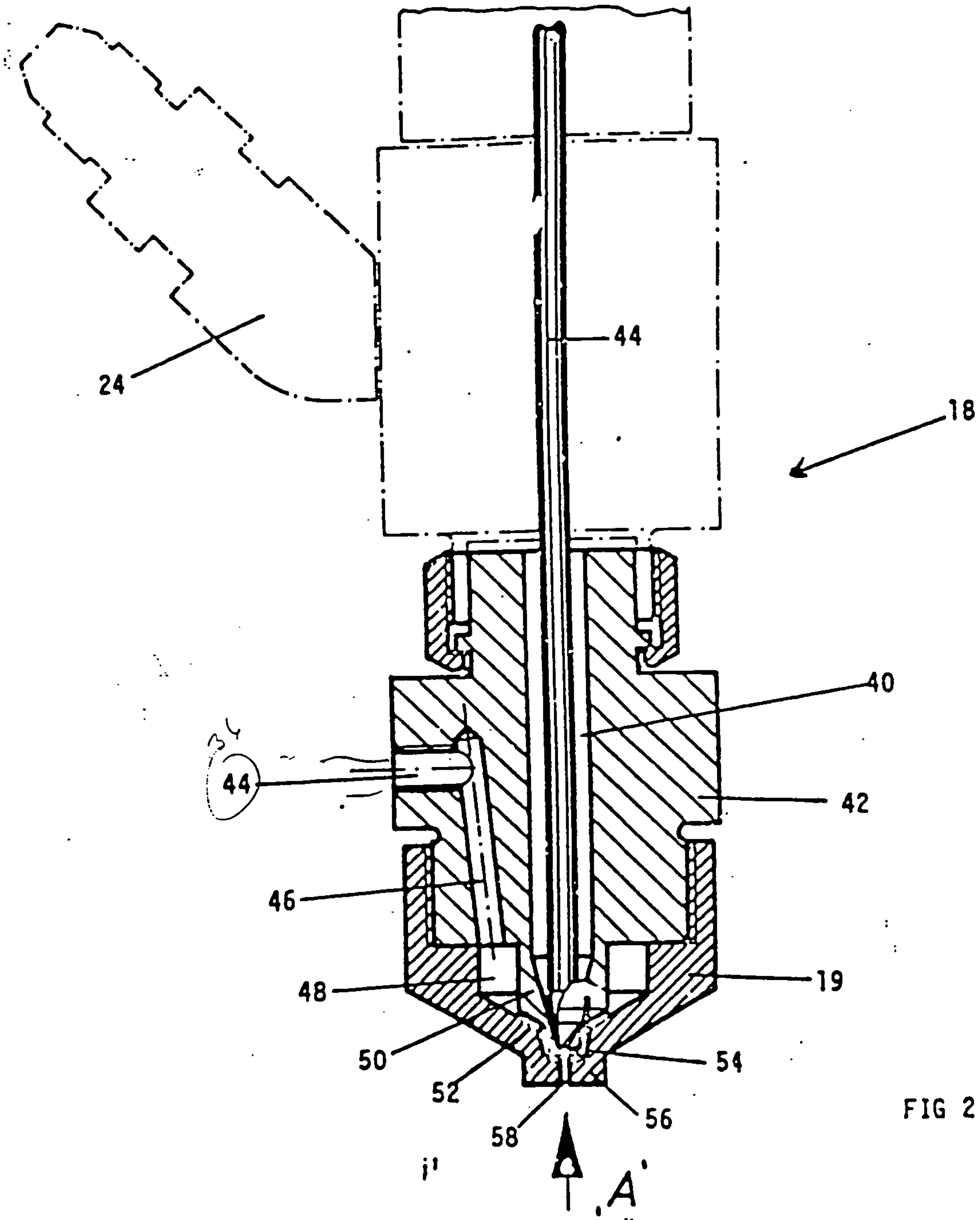

FIG 2

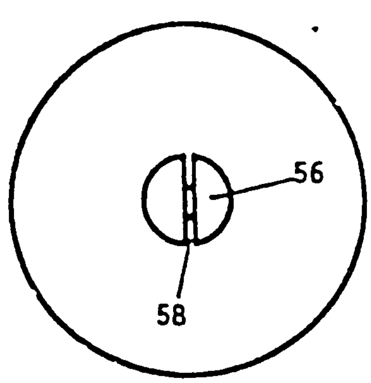

FIG 3

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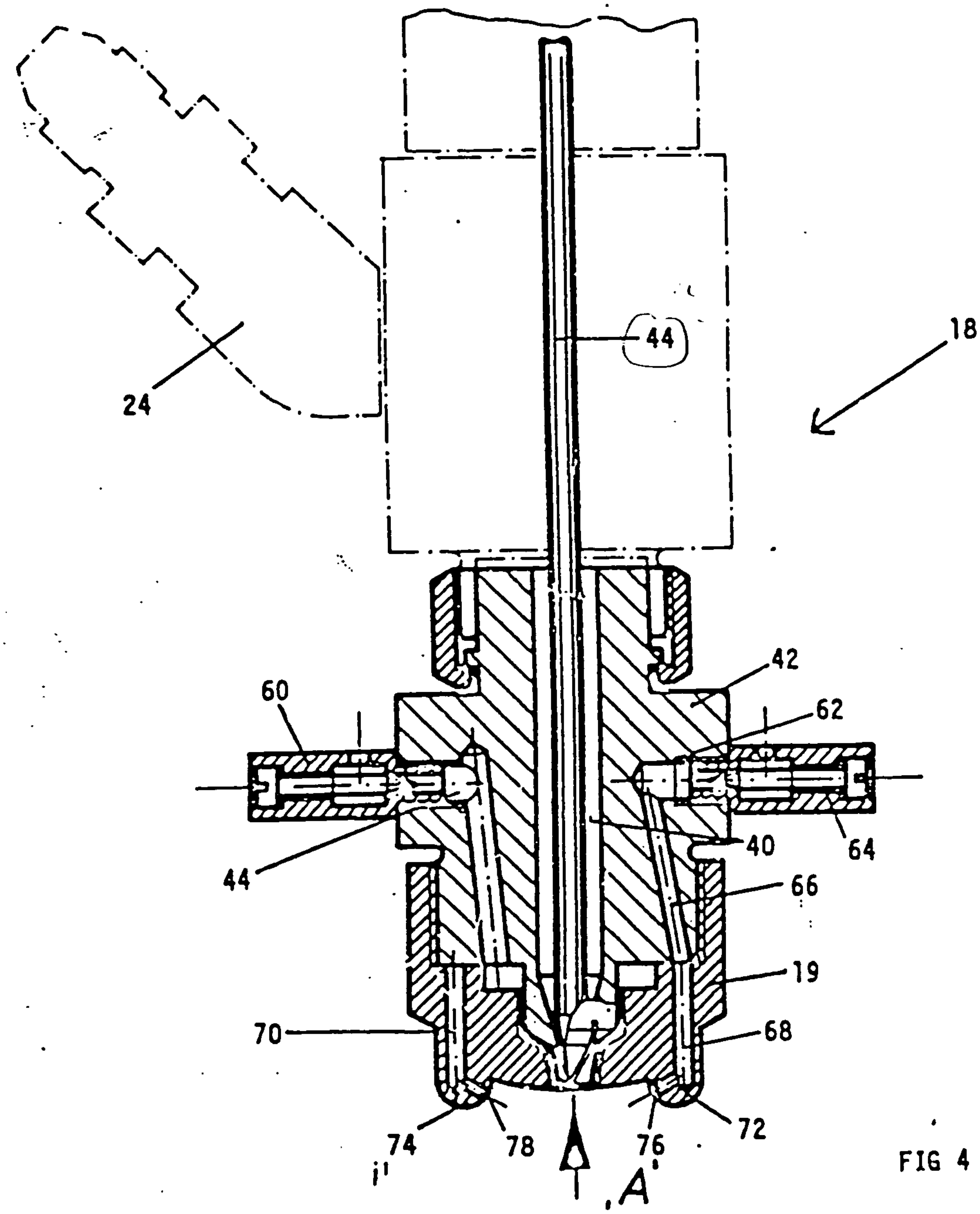

FIG 4

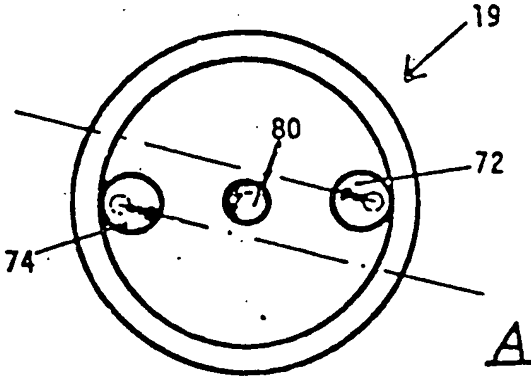

FIG 5

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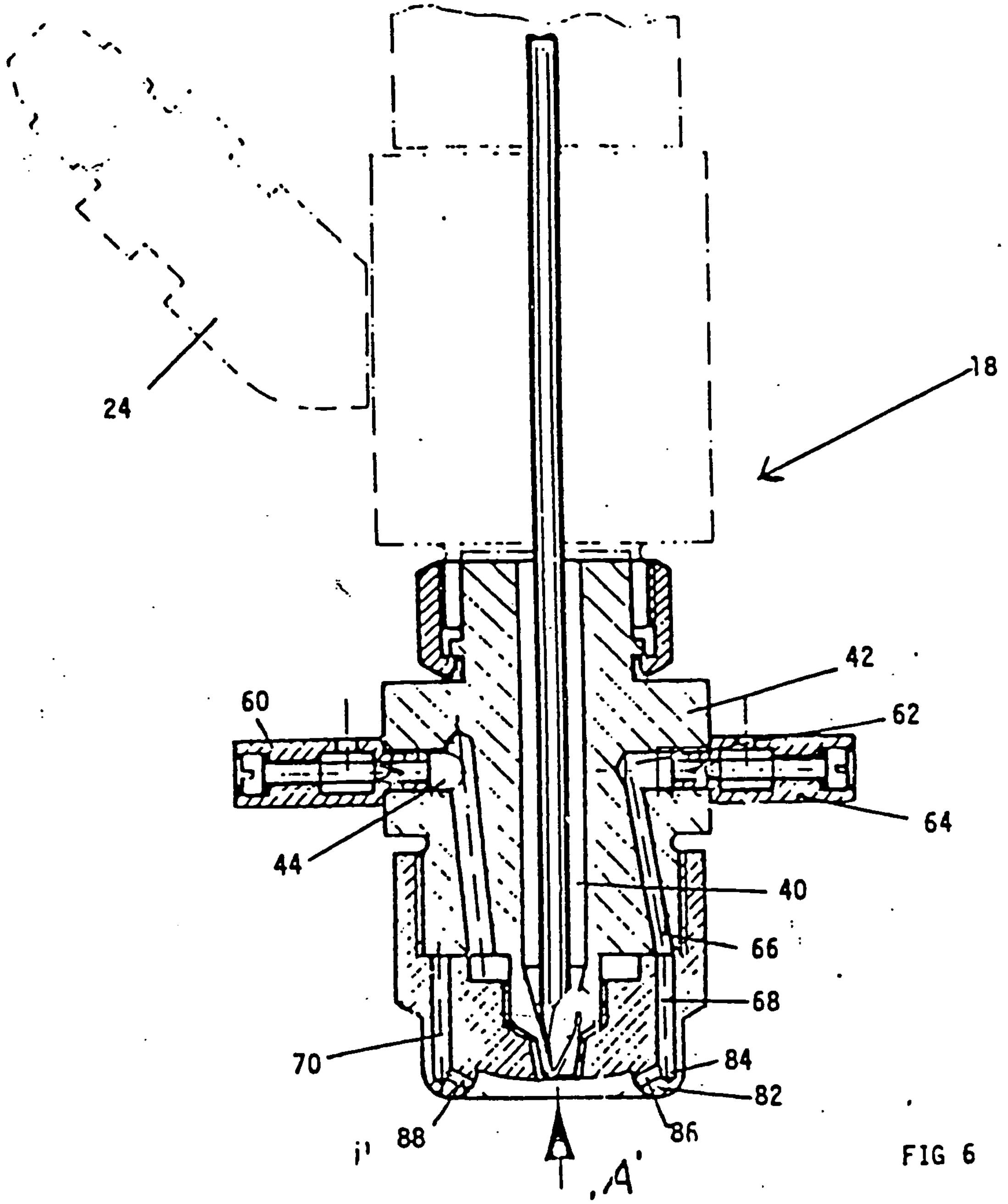

FIG 6

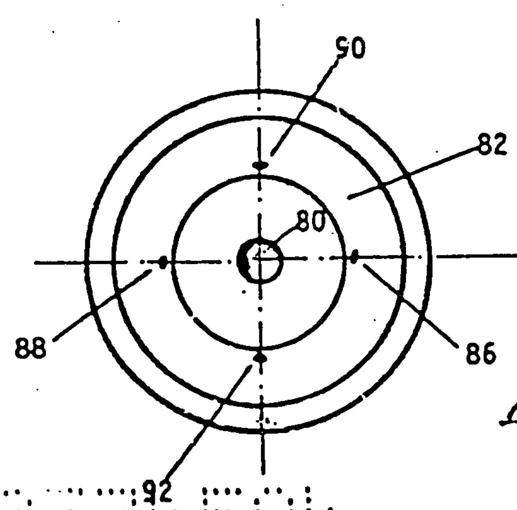

FIG 7

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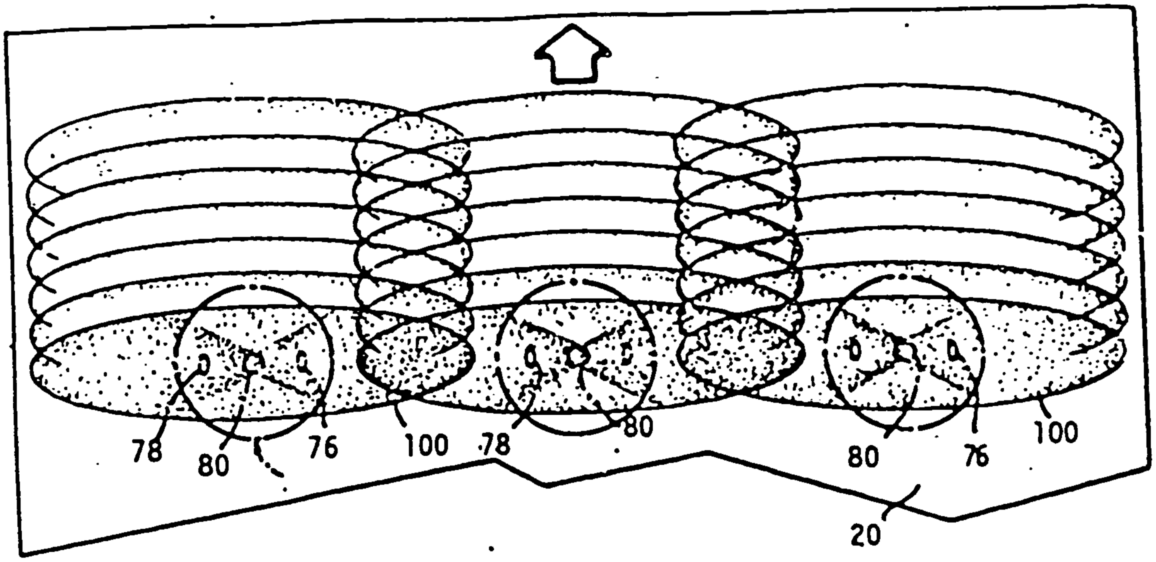

FIG. 8

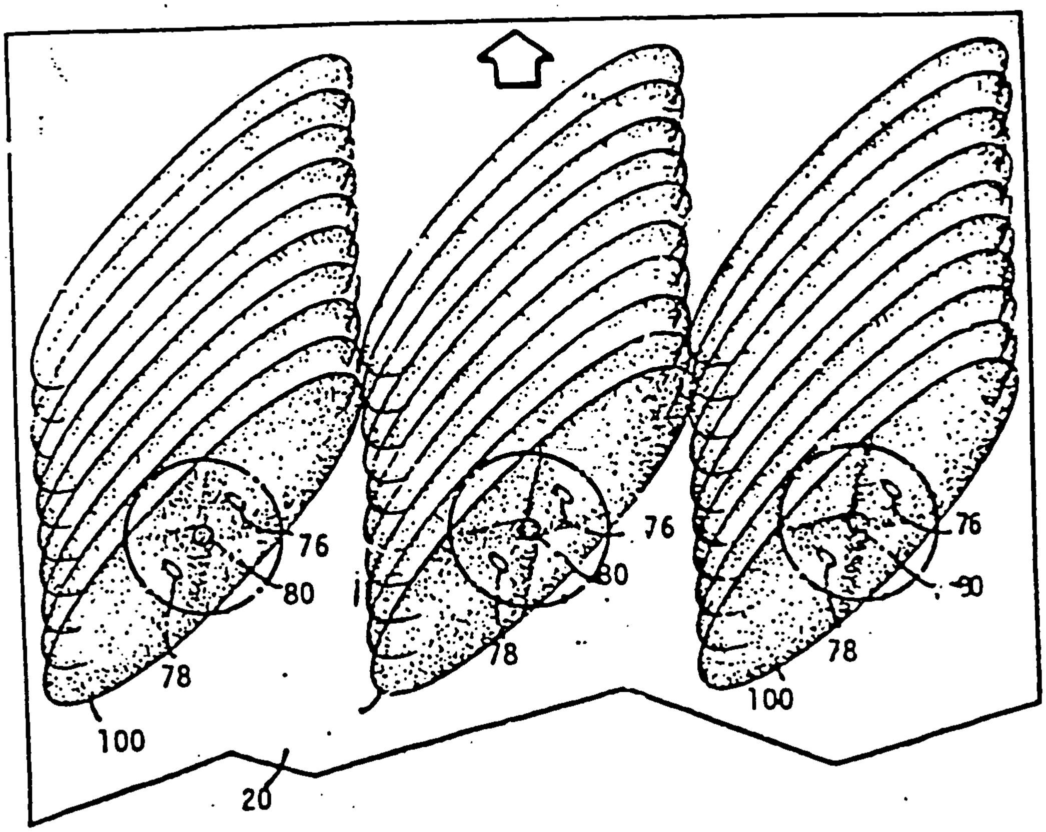

FIG. 9